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Proceedings of the regional peer review meeting on the stock assessment of the southern Gulf of St. Lawrence snow crab stock to 2017 and catch advice for the 2018 fishery

January 24-25, 2018
Moncton, NB

Chairperson: Marc Lanteigne

Fisheries and Oceans Canada
Science Branch
P.O. Box 5030
Moncton, NB E1C 9B6

August 2018

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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SUMMARY

A regional advisory process meeting was held January 24 and 25, 2018 in Moncton (NB) to conduct a science peer review of the status of the snow crab (*Chionoecetes opilio*) of the southern Gulf of St. Lawrence (sGSL). The science review was conducted in response to a request from DFO Fisheries and Aquaculture Management (FAM) for advice on the status of stock in 2017 and catch advice for the 2018 fishery. The assessment on the status of the southern Gulf snow crab resource (Areas 12, 19, 12E and 12F) is based on fishery independent trawl surveys that provide indicators of (commercial biomass), reproductive potential (abundance of mature females) and recruitment. Participants at the science review included science staff from the DFO Gulf Region, personnel from DFO FAM Gulf Region, from universities, from aboriginal communities, from the fishing industry, and from provincial governments. A review of the stock status and the catch advice for the 2018 fisheries were presented as part of the Science Advisory Report, with the support of three research documents. The Science Advisory Report received consensus at the meeting.

INTRODUCTION

A regional science advisory process peer review meeting of the fishery and status of the stock for 2017 and advice for the 2018 snow crab (*Chionoecetes opilio*) fishery of the southern Gulf of St. Lawrence was conducted in Moncton (NB), January 24 and 25, 2018. The terms of reference (TOR) for the science review were developed jointly by DFO Fisheries and Aquaculture Management and DFO Science Branch, Gulf Region (Appendix 1). The meeting started at 10:00 AM, Wednesday, January 24, 2017, and ended at 11:30 AM, Thursday, January 25.

The chair (Marc Lanteigne) reviewed the meeting room arrangements and indicated that simultaneous translation, provided by interpreters contracted through Public Works and Government Services Canada, was available to participants. The chair reviewed the rules of exchange for the meeting, reminding participants that the meeting was a science review and not a consultation. As well, everyone at the meeting had equal standing as participants as there was no observer status at the meeting. Table microphones were provided to ensure good communication during the meeting, to allow for simultaneous translation of the presentations and discussions and as such, exchanges would have to take place one at a time and, if required, through order of the chair. Finally, the objective was to achieve consensus on the appropriateness of the assessment documents and that for the purposes of the science review, the consensus was taken as an absence of opposition. The chair then invited the participants to introduce themselves; the list of participants is provided in Appendix 2. The chair reviewed the terms of reference for the meeting. The draft agenda was reviewed and accepted (Appendix 3).

Following on a commitment made by DFO Science Branch to provide access to the data from the southern Gulf of St. Lawrence snow crab trawl survey prior to the annual peer review of the stock assessment, the survey data files from the snow crab trawl survey from 2017 were distributed as part of the meeting notification to all potential participating organizations on December 15, 2017 (Appendix 4).

Three working papers (WP) for review by meeting participants were made available to confirmed participants and to all industry and aboriginal organizations prior to the science review on January 17, 2018 (Appendix 5). These working papers were:

- WP 1: Review of the 2017 snow crab (*Chionoecetes opilio*) fishery in the southern Gulf of St. Lawrence (Areas 12, 19, 12E and 12F) by M. Hébert, T. Surette, J.-F. Landry and M. Moriyasu.
- WP 2: Summary of the 2017 snow crab trawl survey activities in the southern Gulf of St. Lawrence by R. Allain, T. Surette, J.-F. Landry, S. Boudreau, M. Hébert, E. Wade and M. Moriyasu
- WP 3: The 2017 assessment of the snow crab (*Chionoecetes opilio*) stock in the southern Gulf of St. Lawrence (Areas 12, 19, 12E and 12F) by M. Hébert, T. Surette, E. Wade, J.-F. Landry and M. Moriyasu.

To facilitate the discussions, printed copies of the different presentations were distributed to all participants at the beginning of the meeting. A draft version of the Science Advisory Report was also distributed for review at the end of the presentations. Rapporteur duties were assigned to Renée Allain and Rita Cormier from DFO Science Branch.

This Proceeding constitutes a record of meeting discussions and conclusions.

PRESENTATIONS AND DISCUSSIONS

Participants were requested to wait for the end of the presentation before asking questions.

As requested from participants, it was agreed to forward electronic versions of the presentations in the days following the meeting. It was also agreed to include in the proceedings, a list of research recommendations that were discussed during the meeting. This list is not to be considered as a formal research workplan for the DFO Science team but, as a list of potential research venues to improve knowledge and assessment techniques in the future. Any research of further investigations would be conducted on a priority basis and presented in the proper context (i.e.: Framework science meetings, peer review publications).

REVIEW OF THE 2017 SNOW CRAB (CHIONOCETES OPILIO) FISHERY IN THE SOUTHERN GULF OF ST. LAWRENCE (AREAS 12, 19, 12E AND 12F)

The information was presented by Marcel Hébert (DFO Science, Moncton, NB).

Total landings in the sGSL in 2017 were 43,656 t out of a revised quota of 43,475 t. The allowable quota in the notice to harvesters was 43,822 t. In Area 12, landings were 39,825 t (revised quota of 39,651 t). The mean catch-per unit-of-effort (CPUE) from logbooks increased in 2017 (72.0 kg per trap hauled (kg/th)) compared to 2016 (64.0 kg/th). The mean size of commercial-sized adult males decreased from 111.9 mm of carapace width (CW) in 2016 to 109.8 mm CW in 2017. The incidence of soft-shelled crab remained low at 6.0%. In Area 19, landings reached 2,944 t (revised quota of 2,945 t). The mean CPUE remained high in 2017 at 142.8 kg/th and is comparable to 2016 (142.5kg/th). The mean size of commercial-sized crabs remained high in 2017 (113.7 mm CW). The incidence of white crabs increased from 8.2% in 2016 to 11.6% in 2017. In Areas 12E and 12F, landings were 203 t (revised quota of 199 t) and 684 t (revised quota of 680 t), respectively. In Area 12E, the mean CPUE increased in 2017 (60.9 kg/th) compared to 2016 (51.5 kg/th). The incidence of soft-shelled crab remained low at 2.0% in 2017. In Area 12F, the mean CPUE increased from 43.9 kg/th in 2016 to 72.6 kg/th in 2017. The incidence of soft-shelled crabs decreased from 10.4% in 2016 to 1.9% in 2017.

Discussion

A question was asked on whether the catch per unit of effort (CPUE) data collected in logbooks were reliable and were correlated with landings? DFO Science indicated that the logbook CPUEs obtained by harvesters are very similar to CPUEs obtained with at-sea observers. The time series data from both sources (i.e.: logbooks and at-sea observers) are presented in the working document.

A question was asked about the potential use of CPUE to assist the stock assessment and relationship between CPUE and biomass. DFO Science explained that for numerous reasons, the relationship between CPUE and biomass is very poor. This situation is well known in fisheries. CPUEs are presented as performance indicators of the fishery and not indicators of abundance.

Why are CPUEs in area 19 so high, compared to other areas? DFO Science explained that many factors may explain these high CPUEs: density of traps, abundance of crab, bait, movement of crab from the time of the survey to the time of the fishery (approximately 9-10 months), immersion time and many others. Movement along the coast of Cape Breton and interactions with fishing areas 21 and 22 are certainly possible, as crabs can move in and out of area 19.

Clarifications were provided about the terminology and differences between soft-shelled and white crabs. The percentage of soft-shelled is measured in fishing areas 12, 12E and 12F, and

is based on a durometer reading of 68. The percentage of white crab is measured in fishing area 19 only and is based on a durometer reading of 72. The higher reading on the durometer in area 19 is related to the fact that the season starts in July. The difference is to adjust for the changes of the carapace condition between the spring starting and summer starting seasons.

Although the biomass in recent years has increased, there was no obvious increase or accumulation of old crabs (shell conditions 4 and 5).

A question was asked about the difference in mean size of commercial crabs in each fishing areas and why crabs were always larger in area 19. DFO Science explained that this information is not used for stock assessment purposes. Science does not have the explanation for the consistent larger mean size in area 19, and did not conduct a thorough analysis of the entire southern Gulf of St. Lawrence. Some limited investigations were conducted in the past, and similar larger mean sizes of crabs in localized areas within fishing area 12 have been observed. Chaleur Bay would be a good example of a sector with larger size commercial crabs compared to the rest of area 12. This observation was corroborated by harvesters present at the meeting.

SUMMARY OF THE 2017 SNOW CRAB TRAWL SURVEY ACTIVITIES IN THE SOUTHERN GULF OF ST. LAWRENCE

The information was presented by Renée Allain (DFO Science, Moncton, NB).

The details of the 2017 snow crab trawl survey of the southern Gulf of St. Lawrence were presented. The primary objective of the survey is to provide data on abundance and distribution of snow crab and other by-catch species. In-depth analysis results of the survey data are presented in the assessment document. The survey was conducted from July 10 to September 22 using a chartered commercial fishing vessel, the "Jean Mathieu". A total of 355 grids were visited and 353 grids were successfully sampled. The total duration of the survey was 75 days with 42 days at sea. Total number of adolescent male crab (including immature crab) captured went from 11,431 individuals in 2016 to 12,060 in 2017, whereas adult male crab catches decreased from 5,453 to 4,995. For commercial-male crabs, the number captured decreased from 2,896 in 2016 to 2,001 in 2017. For females, the total number of adolescent female crabs captured increased from 5,593 in 2016 to 5,891 in 2017, and the number of adult female crabs increased from 7,891 in 2016 to 8,819 in 2017. Recorded by-catch during the 2017 survey consisted of 75 species/groups comprised of 48 fish and 27 invertebrates.

The chair indicated that, in addition to the presentation, more information was posted on a wall of the meeting room. As in previous years, the Science team prepared a poster presenting a map of the trawl survey polygon with a mosaic of photos showing the catch of each tow conducted in 2017.

Discussion

To the question on whether the timing of the survey and area fished had an effect on biomass estimates, it was indicated that the timing of fishing a particular area may change slightly from one year to the next but is not deemed to have an impact on the biomass estimate. The objective when conducting the survey is to keep the timing and sequence of sampling sectors in the southern Gulf consistent each year.

As for any standard scientific survey, the assumption is that the survey timing and sequence avoids sampling the same group of crab twice (i.e.: crabs in 1 sampling station cannot move to a neighbour station and be sampled again). DFO Science feels that present sampling design does not violate this assumption.

The trawl survey is primarily designed to assess the biomass in the entire southern Gulf of St. Lawrence. It is not designed to assess the biomass by fishing areas, especially small fishing areas and "buffer zones" with very few sampling stations.

From an area 19 perspective; harvesters are seeing important changes in water temperature during the fishing season and between years. It is suggested that the date of the survey in a particular grid may have a distinctive effect and add sampling error on that sampling point. It was requested that in the future, the working document could include a table of the survey timing for each grid, in addition to the figure (i.e. map with sampling sites) which is not easy to decipher.

DFO Science team indicated that there were some difficulties receiving the Netmind signals from sensors installed on the trawl. These difficulties were resolved mid-way during the survey by cleaning the underwater receivers installed on the vessel hull. Most of the impacted tows were in deeper waters at the beginning of the survey. Normally during a tow, the science team is receiving approximately 40 trawl dimension's measurements. For about half of the sampling sites, the team was receiving approximately 25-30 trawl measurements. Adjustments were made during post-processing of the data to estimate the towed surface sampled. This situation was not an issue for the last half of the survey. The problem did not impact the touchdown post-processing which is monitored by Minilogs. Other sensors (StarOddi and Minilogs) were used to validate the towed surface calculations.

There were some questions about the colorimeter study presented in the appendix of the working document. It was explained that preliminary results suggest that the tool may provide a promising venue to provide a quantitative assessment of shell condition. More work and samples are needed to fully assess this new approach.

Can the high abundance of crabs in area 12F during the 2017 survey be explained by a difference in the sampling timing (ex: sampling was done later for the same area in 2016)? There was little difference in sampling timing in 2016 and 2017 specifically in the area of high abundance. In both years, in the same area, there was evidence of high abundance ("hot spots") of crabs of different sizes. It does not seem to be a year effect, but it cannot be confirmed without further investigations. Similar events have been seen in the past.

THE 2017 ASSESSMENT OF THE SNOW CRAB (CHIONOECETES OPILIO) STOCK IN THE SOUTHERN GULF OF ST. LAWRENCE (AREAS 12, 19, 12E AND 12F)

The results of this working paper were presented in segments to allow a logical flow of information and discussions on the key elements of the assessment.

Southern Gulf of St. Lawrence snow crab stock assessment for the 2018 fishery

The information was presented by Marcel Hébert (DFO Science, Moncton, NB).

The 2017 assessment of the southern Gulf of St. Lawrence (sGSL) snow crab, *Chionoecetes opilio*, stock (Areas 12, 19, 12E and 12F) is presented. Snow crab in the southern Gulf of St. Lawrence is considered as a single stock unit for assessment purposes. The 2017 assessment was conducted as per the recommendations of the Snow Crab Assessment Methods Framework Science Review held in November 2011 (DFO 2012). The exploitation rate of the 2017 fishery in the sGSL was 44%. The 2017 post fishery survey biomass of commercial-sized adult male crabs was estimated at 66,021 t (95% confidence intervals 57,456 to 75,495 t), a decrease of 33.4% from 2016. The available biomass for the 2018 fishery, derived from the 2017 survey, is within the healthy zone of the PA Framework. The residual biomass from the 2017 survey was estimated at 14,759 t, a decrease of 40.7 % compared to the 2016 estimate.

Seventy-eight percent (78 %) of the 2017 survey biomass, available for the 2018 fishery, is composed of new recruitment (51,262 t). The recruitment to the commercial biomass from the 2017 survey decreased by 31.0% compared to 2016.

The September multi-species bottom trawl survey conducted annually by the marine fish science team shows a decrease in the biomass of commercial-sized adult male in 2017, similar to what was estimated from the dedicated snow crab trawl survey.

Discussion

The chair of meeting added that an independent research scientist was asked to conduct an independent assessment with the same kriging method used by DFO, and the same survey database provided to all participants of this meeting. This independent assessment has been requested for the last 4 years as part of the annual peer review process. The results from were very similar to the DFO's estimates and suggest that the geostatistical analyses were conducted correctly. The difference, of approximately 360 t, can be attributed to slightly different analytical approaches mainly the variogram and neighboring of the kriging points.

A participant asked if there were particular patterns in the geographical distribution of females. The maps presented in the working document are showing the distribution of primiparous and multiparous females. The distribution patterns are variable each year.

Some clarifications were requested about the definition and composition of total mortality. It was mentioned that the term mortality may also include crabs that are still alive, but have left the sampling polygon or have become non available to the sampling gear.

There was a discussion on the issue of total mortality calculation and variability over the years. Factors that may explain the estimated high values of total mortality were discussed. Science presented some new calculations of mortality for sub-legal size male crabs and females and indicated that the issue of spatio-temporal variability of total mortality by size-classes, shell conditions and sex is being investigated.

Some clarification was requested about the definition of skip-molters. Science indicated that skip-molters usually appear before a peak of abundance of commercial size males. They may skip for one year, but the majority would molt the following year. The question was asked if skip-molters are distributed randomly within the southern Gulf or are showing localized abundances. The information was not available at the time.

A participant from the fishing industry commented that the Precautionary Approach for snow crab was implemented in 2010-2011 by DFO, without the full support of harvesters in area 19. The lower and upper limit reference points were not chosen by harvesters. The PA resulted in a drastic catch reduction (i.e.: TAC) in area 19, and a sudden increase in CPUEs.

Biomass geographic distribution in management areas (including buffer zones)

The information was presented by Marcel Hébert (DFO Science, Moncton, NB).

The kriging polygon (and the survey area) has a total area of 57,840 km^2 and is the basis to calculate the total southern Gulf of St. Lawrence (sGSL) biomass estimate. As the fishery is managed in four areas, DFO Fisheries and Aquaculture Management has requested estimates by management areas. The sGSL kriging polygon was therefore partitioned into the four management areas. Biomass estimates were also calculated for the unassigned zone A (above Areas 12E and 12F) and the two no-fishing buffer zones (B and C) and assigned to management areas following an agreed distribution. Biomasses by area and confidence intervals were presented in a table.

These calculations are conducted for the sole purpose of assisting DFO Fisheries and Aquaculture Management and harvesters in sharing the resource within the fishing areas of the sGSL. Commercial biomass estimates in small fishing areas, buffer zones and in the unassigned zone have very large confidence intervals given the low number of stations within these small zones. Since only the mean values are being considered in the overall sharing calculation, the commercial biomass estimates attributed to these small areas need to be taken with extreme caution.

Discussion

There was a discussion to verify if the high abundance of crabs observed in area 12F in 2017 could be predicted in previous surveys, or if the timing of the survey could be a factor. By looking at the distribution of smaller size crabs in previous years as a proxy, it somewhat matches the location of the high abundance of commercial crabs observed in 12F in 2017. The ideal comparison would be to compare the 2017 commercial size map with the 2016 map of male crabs, one molt size before the fishery. Further investigation and data processing would be required to produce these maps.

In terms of timing of the survey for area 12F, the stations showing high abundance of crabs in 2017 were sampled at approximately the same time in 2016.

Overview of physical environmental conditions in the southern Gulf of St. Lawrence during 2017

The information was presented by Joël Chassé (DFO Science, Moncton, NB).

The presentation provided an overview of 2017 physical environmental conditions with historical context. There was no working document associated with this presentation but, a summary of the physical environmental conditions relative to snow crab was inserted as a section in WP3.

In summary, 2017 was characterized by a relatively warm winter with lower than normal ice severity. There was a higher than normal freshwater runoff and an increase in stratification over the Magdalen Shallows during the summer. The surface of the ocean was warmer than normal in the sGSL for most of the summer. In September, bottom temperatures were normal over the main portion of the Magdalen Shallows, slightly warmer than normal along the Laurentian Channel and cooler than normal around PEI.

In most areas, bottom temperatures were similar or slightly cooler in 2017 compared to 2016. Water with temperatures <0°C was still present in September 2017 over the Magdalen Shallows but the volume was slightly larger than in 2016.

The areal habitat index in 2017 was above the long-term (1981-2010) average. The mean temperature within the habitat area in 2017 is still above the long term average but decreased from 2016. The combined habitat index is close to normal and increased from 2016.

The deep water (i.e.: Laurentian Channel) is still warming in the Gulf of St. Lawrence and the outcome of this warming event is not known.

Discussion

There were some questions and a discussion around hypoxia and acidification of the water. Joël Chassé indicated that hypoxia is a phenomenon that occurs in deep waters, especially at the head of the Laurentian Channel. Hypoxia is not observed on snow crab fishing grounds or in snow crab habitat. In term of acidification, the monitoring activities have increased and more research on the topic is being done.

Freshwater runoff may change in the future. Climate change forecast are predicting a 15% increase in precipitation in the next 50 years. It is difficult to predict what will be the impact of these changes on the physical environmental conditions and water circulation in the sGSL.

A participant asked if bottom temperature could be incorporated in the overall assessment and kriging analysis (ex: bottom temperature as external drift). Presently, depth is used as external drift in kriging. Bottom temperature could be used but, there are numerous factors that would make it difficult to use. This topic was discussed during the 2011 framework (DFO 2012) and was not retained for the kriging analysis.

Harvesters in area 19 indicated that they collect a lot of bottom water temperature at fixed stations and they are willing to share these data with the science team.

Precautionary Approach and risk analysis

The information was presented by Marcel Hébert (DFO Science, Moncton, NB).

The estimated commercial biomass available for the 2018 fishery in the sGSL is 66,021 t (95% confidence intervals 57,456 to 75,495 t), which is in the healthy zone of the precautionary approach framework. Based on the agreed harvest decision rule which has been assessed as compliant with the PA, the point estimate of the biomass in the 2017 survey of 66,021 t corresponds to an exploitation rate of 38.3% and a Total Allowable Catch (TAC) of 25,286 t for the 2018 fishery.

The risk analysis also provides predictions of the commercial biomass in the 2018 survey, assuming the corresponding catch level is taken in 2018. At the decision rule TAC value of 25,286 t for the 2018 fishery, the commercial biomass predicted for the 2018 post-fishery survey and for the 2019 fishery, is 69,780 t, with a 95% confidence interval range of 55,110 to 84,030 t.

Discussion

Some clarifications were requested about the probability for the different catch options and projections for 2019.

REVISION OF THE SCIENCE ADVISORY REPORT

The draft Science Advisory Report (SAR) of the 2017 fishery characteristics, biomass estimates and risk analysis of catch options for 2018 was reviewed by meeting participants on January 25, 2018. The document overall format was similar to the previous year advisory report (DFO 2017). Minor edits were suggested by participants. There was consensus for publishing the proposed Science Advisory Report provided edits discussed at the meeting were adopted in the final version.

MEETING PRODUCTS AND CLOSURE OF MEETING

There was consensus for publishing the proposed Science Advisory Report: "Assessment of snow crab in the southern Gulf of St. Lawrence (Areas 12, 19, 12E and 12F) and advice for the 2018 fishery", provided edits discussed at the meeting were made in the final version. Efforts were made during the science peer review process to acknowledge and address all comments and concerns raised by participants, provided they were appropriate and within the confines of acceptable peer review practice.

In the following months, the three working papers presented at the meeting are to be upgraded to research documents in support of the advisory report.

The Science Advisory Report, the three research documents and the present proceedings are expected to be posted on the Canadian Science Advisory Secretariat (CSAS) website in the coming months.

LIST OF RESEARCH RECOMMENDATIONS

It was proposed to complete the work initiated a few years ago with the CPUEs. Can CPUEs be more than fishing performance indicators? Can they be a value-added parameter in the overall biomass assessment or be used to explain localized spatial events/observations of the snow crab population within the southern Gulf?

It was proposed to further investigate the spatio-temporal variation of mean size of mature males within the biological unit. To what extent does the mean size of mature male crab differ in the southern Gulf and in other areas? Can this be related to localized environmental factors or other unknown factors?

It was proposed to investigate the potential effect of survey timing on the biomass estimates and distributions within the southern Gulf. Can some of the year effect (localized unexpected "hot spots" of abundance) be explained? This investigation will involve looking at the distribution of male crabs of the previous molt size the year before, to see if the "hot spot" was present the year before and was then predictable. A tagging study will also be an important element, especially in the Cabot Strait and western Cape Breton sectors.

It was mentioned that the tool used and agreed by DFO and harvesters (i.e.: cookie cutting using geostatistic method) for partitioning the southern Gulf biomass by fishing area and buffer zones every year may need to be revisited. The year effects observed in the distribution of commercial crabs often occurs at the perimeter of the survey polygon, and within or in the vicinity of small fishing areas. The biomass estimates by area are already highly uncertain, especially in small fishing areas, and these year events are further increasing the level of uncertainty on the estimates. It is important to understand that if Science is asked to assist in developing a new tool for sharing the resource, the initial request and options need to come from FAM and the harvesters. This issue would certainly need to be discussed at the Snow Crab Advisory Committee.

It was proposed to investigate the impact of bottom temperature fluctuations on crab distribution and abundance. Environment, mainly temperature, is expected to go through changes, over the snow crab habitat in the southern Gulf, which have not been seen before. Can temperature be used as a parameter (ex: external deterministic drift for crab densities) with the kriging method used to assess the biomass?

REFERENCES CITED

DFO. 2012. Proceedings of the Gulf Region Science Peer Review Framework Meeting of Assessment Methods for the Snow Crab Stock of the southern Gulf of St. Lawrence; November 21 to 25, 2011. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2012/023.

DFO. 2017. Assessment of snow crab (*Chionoecetes opilio*) in the southern Gulf of St. Lawrence (Areas 12, 19, 12E and 12F) and advice for the 2017 fishery. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2017/004.

APPENDICES

APPENDIX 1. TERMS OF REFERENCE.

STOCK ASSESSMENT OF THE SOUTHERN GULF OF ST. LAWRENCE SNOW CRAB STOCK FOR 2017 AND CATCH ADVICE FOR THE 2018 FISHERY

Regional Peer Review – Gulf Region

January 24 and 25, 2018
Moncton, NB

Chairperson: Marc Lanteigne

Context

In support of DFO Ecosystems and Fisheries Management request for advice, DFO Science Branch Gulf Region undertakes a peer review of the stock status of the snow crab (*Chionecetes opilio*) biological unit of the southern Gulf of St. Lawrence (management areas 12, 12E, 12F and 19).

Objectives

Develop science advice for the management of the snow crab fishery for the southern Gulf of Saint Lawrence biological unit for the 2018 fishing season. The following considerations and items will be on the agenda for this peer review meeting.

Present for each of the four management areas in the southern Gulf (12, 12E, 12F, 19):

- commercial fishery statistics for the 2017 fishing season (catches, landings and effort, sea sampling),
- indicators of fishery performance: catch per unit of effort, size and carapace condition of commercial size crab.

Present the following estimates based on the post-fishery directed snow crab trawl survey for the extended polygon of 20 to 200 fathoms for 2017 and previous years:

- the exploitable commercial biomass (adult male crab of carapace width >= 95 mm) for the southern Gulf biological unit and for each of the four management areas (12, 12E, 12F and 19) within the southern Gulf biological unit,
- the abundance of male crab recruitment for the near future,
- the present and future abundance of the spawning stock,
- the size structure of the male and female crab by stage of maturity,
- the realized exploitation rates and loss rates of the commercially exploitable biomass.

Present analyses of indicators of snow crab abundance and distribution based on the September multi-species research vessel survey of the southern Gulf of St. Lawrence.

Perform a risk analysis of catch options for the 2018 fishery year, including projections with uncertainty of the predicted adult male commercial biomass components (residual biomass, recruitment biomass) for the 2019 fishery year. This risk analysis will be prepared for the southern Gulf biological unit, relative to the reference points (limit, upper reference), and according to the agreed decision rule developed for the southern Gulf of St. Lawrence biological unit and fishery.

Present the information on the environmental factors which may influence the abundance and population dynamic of the snow crab stock of the southern Gulf of St. Lawrence.

Expected Publications

- CSAS Science Advisory Report on status and fisheries advice of the snow crab biological unit of the southern Gulf of St. Lawrence (management units 12, 12E, 12F, and 19)
- CSAS Proceedings
- CSAS Research Documents

Participation

- Fisheries and Oceans Canada (DFO) (Ecosystems and Oceans Science, and Ecosystems and Fisheries Management)
- Fishing industry
- Aboriginal organizations
- Provinces
- External experts

APPENDIX 2. LIST OF PARTICIPANTS.

Name	Affiliation	24 Jan 2018	25 Jan 2018
Amélie Rondeau	DFO Science Gulf Region / MPO Science Région du Golfe	X	X
Basil MacLean	Area 19 Snow Crab Fishermen's Association	X	X
Bruno-Pierre Bourque	Groupe de pêcheurs zone F inc.	X	X
Carter Hutt	PEI Snow Crab Fishermen Association	X	X
Daniel Ricard	DFO Science Gulf Region / MPO Science Région du Golfe	X	X
David MacEwen	Province of PEI	X	X
Denny Isaac	Listiguj Mi'gmaq Government	X	X
Devin Ward	Mi'gmawe'l Tplu'taqnn Incorporated (MTI)	X	
Doug Fraser	PEI Fishermen's Association	X	X
Francis Parisé	Association des Crabiers Gaspésiens (ACG)	X	X
Frank Hennessey	Association interprovinciale des crabiers zone 12E	X	
Gilles Duguay	Regroupement des pêcheurs professionnels du sud de la Gaspésie Inc.	X	X
Jason Keoughan	Commercial Fisheries, Buctouche MicMac Band	X	
Jean-François Landry	DFO Science Gulf Region / MPO Science Région du Golfe	X	
Jean Lanteigne	Association des pêcheurs professionnels crabiers acadiens Inc.	X	X
Jean Marc Arseneau	Regroupement des pêcheurs professionnels des Iles-de-la-Madeleine (RPPIM)	X	X
Joël Chassé	DFO Science Gulf Region / MPO Science Région du Golfe	X	X
Kris Vascotto	Groundfish Entreprise Allocation Council (GEAC) (invited to participate by Area 19 harvesters)	X	X
Lévi Noël	Association des pêcheurs professionnels crabiers acadiens Inc.	X	X
Louis Ferguson	Union des pêcheurs maritimes (UPM)	X	X
Maité Chavez	DFO Resource Management Quebec Region / MPO Gestion des ressources Région du Québec	X	X
Marc Lanteigne	DFO Science Gulf Region / MPO Science Région du Golfe	X	X
Marcel Hébert	DFO Science Gulf Region / MPO Science Région du Golfe	X	X
Mark Boyd	Area 18 Crab Fishermen's Association	X	X
Martin Mallet	Union des pêcheurs maritimes (UPM)	X	
Matthew Hardy	DFO Science Gulf Region / MPO Science Région du Golfe	X	X
Mikio Moriyasu	DFO Science Gulf Region / MPO Science Région du Golfe	X	X
Olivia Levi	Mi'gmawe'l Tplu'taqnn Incorporated (MTI) fisheries consultation coordinator	X	X
Paul Anderson	PEI Mobile Groundfish Fishermen's Association	X	
Paul Boudreau	Regroupement des pêcheurs professionnels des Iles-de-la-Madeleine	X	X
Pierre Dupuis	Province du NB	X	X
Renée Allain	DFO Science Gulf Region / MPO Science Région du Golfe	X	X

Name	Affiliation	24 Jan 2018	25 Jan 2018
Rita Cormier	DFO Science Gulf Region / MPO Science Région du Golfe	X	X
Robert Haché	Association des crabiers acadiens (ACA)	X	X
Stéphanie Boudreau	DFO Science Gulf Region / MPO Science Région du Golfe	X	X
Stéphanie Ratelle	DFO Science Gulf Region / MPO Science Région du Golfe	X	
Steven Chiasson	Area 19 Snow Crab Fishermen's Association	X	X
Sylvie Leger	DFO Resource Management Gulf Region / MPO Gestion des ressources Région du Golfe	X	X
Tobie Surette	DFO Science Gulf Region / MPO Science Région du Golfe	X	X
Tommy Campbell	Area 19 Snow Crab Fishermen's Association	X	X

APPENDIX 3: AGENDA OF THE MEETING

Agenda item	Time
Wednesday January 24, 2018	
Meeting room open	9:30 – 10:00
Introduction, review of agenda	10:00 – 10:20
Description of the 2017 snow crab fishery in the southern Gulf of St. Lawrence (WD01e). Report of the 2017 trawl survey for snow crab in the southern Gulf of St. Lawrence (WD02e). The 2017 assessment of the snow crab stock (southern Gulf, areas 12, 19, 12E and 12F) (WD03e).	10:20 – 12:00
Lunch	12:00 – 13:00
The 2017 assessment of the snow crab stock (southern Gulf, areas 12, 19, 12E and 12F) (WD03e) (continued). Environmental conditions Risk analysis and catch options for 2018 (WD03e)	13:00 – 17:00
Break	*15:00 – 15:15*
Thursday January 25, 2018	
Meeting room open	8:00 – 8:30
Editing of draft advisory report on status of snow crab from the southern Gulf (all participants).	8:30 – 10:15
Break	10:15 – 10:30
End of peer review meeting	11:30

APPENDIX 4. NOTIFICATION MESSAGE OF THE MEETING AND DISTRIBUTION OF SNOW CRAB TRAWL SURVEY DATA, DECEMBER 15, 2017.

From: Chaput, Gerald
Sent: December-15-17 3:38 PM

Subject: Notification de la revue scientifique pour le crabe des neiges, sud du Golfe du Saint-Laurent, janvier 2018 / Notification of the science review meeting for snow crab of the southern Gulf of St. Lawrence January 2018

English message follows:

Bonjour.

Vous trouverez en pièce-jointe la notification de la réunion scientifique pour passer en revue l'évaluation du stock de crabe des neiges du sud du Golfe du Saint-Laurent. La revue des sciences sur l'état du stock de crabe des neiges du sud du golfe du Saint-Laurent pour 2017 et l'avis pour la pêche de 2018 sera les 24 et 25 janvier, 2018.

La réunion sera au Delta Hotels Beausejour, 750 rue Main, Moncton (N-B). La réunion débutera à 10h00 le mercredi 24 janvier et terminera au plus tard 13h00 le jeudi 25 janvier 2018.

Vous pouvez nommer un participant par association pour cette revue. Je vous demande de me communiquer le nom de la personne ici le 8 janvier 2018. Les documents de travail seront disponibles à tous ceux et celles qui le désirent, même s'ils ne sont pas des participants à la revue des sciences.

Une notification sera envoyée lorsque les documents seront disponibles, et au plus tard le 17 janvier 2018.

Suite aux engagements du secteur des Sciences du MPO de fournir les données du relevé du crabe des neiges du sud du golfe du Saint-Laurent avant la revue par les pairs de l'évaluation annuelle, je vous transmets en pièce-jointe le fichier de données du relevé de 2017 qui sert à l'estimation de la biomasse du crabe des neiges.

Il y a deux fichiers :

« **Relevé crabes des neiges 2017 - Description du fichier de données.pdf** » contient une description du contenu et du format des informations dans le fichier de données.

«**crabe des neiges données de relevé 2017.txt** » est le fichier des captures par trait pour toutes les stations échantillonnées en 2017, en format ASCII et qui se lit facilement avec un logiciel de traitement de données (Excel, OpenOffice,...), en format « tab » délimité.

Vous pouvez obtenir vous-même une estimation grossière de la biomasse de crabe des neiges dans le Golfe en utilisant la moyenne des poids capturés sur les 354 stations qui ont été échantillonnées avec succès en 2017.

La biomasse, en tonnes par km carré, à chaque station se calcule ainsi :

Poids en kg par mètre carré de crabe dans les prises du chalut par station : colonne R qui donne poids en kg pour les crabes mâles matures de taille commerciale toutes conditions de carapace confondues (ou colonne T pour la biomasse résiduelle, crabes de conditions de carapace 3 à 5) divisé par la surface chalutée par station (colonne G, en mètres carrés) pour obtenir le poids en kg par mètre carré.

Multiplier chaque valeur par 1000 pour obtenir la biomasse en tonnes par km carré (il faut diviser par 1000 pour passer de kg à tonnes, ensuite multiplier par 1 000 000 pour passer de mètre carré à kilomètre carré, donc on peut passer directement en multipliant par 1000).

Après avoir calculé la moyenne de ces valeurs (tonnes par km carré) sur les 354 stations échantillonnées en 2017, (ce qui donne 1,147 tonnes par km carré), il faut multiplier la moyenne par la surface du polygone du sud du Golfe du Saint-Laurent (57 840 km carrés) pour obtenir l'estimation grossier de la biomasse commerciale totale en 2017, soit 67 403 tonnes.[1]

Prudence car ce n'est pas la valeur qui sert dans l'évaluation. La biomasse de l'évaluation est estimée par la méthode de krigeage et géostatistiques, ce qui va donner une valeur différente de la moyenne arithmétique.

Les données sont préliminaires. Une assurance de la qualité et des vérifications ultérieures, comprenant l'examen scientifique par les pairs prévu pour janvier 2018, pourraient entraîner des différences entre l'information affichée et celle qui paraîtra dans la base de données finale. Les utilisateurs devraient utiliser l'information avec prudence, et ce, à leurs risques. Le gouvernement du Canada n'est pas responsable de l'exactitude, de la disponibilité, de la qualité, de la fiabilité, de la convivialité, de l'exhaustivité ou de l'actualité des données. En aucun cas le gouvernement du Canada ou ses employés, fonctionnaires ou agents n'auront d'obligation envers l'utilisateur pour toute raison que ce soit, y compris les allégations découlant d'un contrat ou d'une responsabilité délictuelle, ou pour perte de revenus ou de bénéfices, ou pour des dommages spéciaux, accessoires, indirects ou consécutifs découlant de l'utilisation de cette information préliminaire.

Si vous décidez de continuer, vous vous trouvez à accepter les conditions susmentionnées.

Je vous souhaite un Joyeux Noël et mes meilleurs voeux pour l'an 2018. Au plaisir de vous voir en janvier 2018.

Merci,

Hello.

You will find as an attachment the notification of the upcoming science peer review meeting of the assessment of the snow crab stock of the southern Gulf of St. Lawrence. The science peer review meeting of the assessment of the snow crab stock of the southern Gulf of St. Lawrence for 2017 and advice for the fishery for 2018 will be held January 24 and 25, 2018.

The meeting will be held at the Delta Hotel Beausejour, 750 Main Street, Moncton (NB). The meeting will begin at 10:00 AM Wednesday January 24 and should finish no later than 1:00 PM Thursday January 25, 2018.

You may nominate one participant per association for this science review. Please communicate to me the name of the participant before January 8, 2018.

As in previous years, the working documents will be made available, via a website, to anyone who wishes to obtain them, even if they are not participating at the science review. A notice will be sent when the documents become available at the latest January 17, 2018.

Following on a commitment made by DFO Science Branch to provide access to the data from the southern Gulf of St. Lawrence snow crab trawl survey prior to the annual peer review of the stock assessment, you will find attached the survey data files from the snow crab trawl survey from 2017.

The two files attached are:

"Snow Crab Trawl Survey 2017 - Data File Description.pdf" which explains the content and format of all the data files.

"**snow crab trawl survey data 2017.txt**" which is the catch data by individual station for all stations sampled in 2017, in text format. This file can be opened with any spreadsheet such as Excel, OpenOffice, import the file as a "tab" delimited file.

You can get a rough estimate of the biomass of snow crab in the Gulf yourself based on the average of the weight captured, per square km, over the 354 stations successfully sampled in 2017.

Biomass in tons per sq. km at each station is calculated as follows:

Weight of crab in kg per square metre at each station can be calculated using: column R gives weight in kg for adult male mature crab of commercial size of all carapace conditions (or column T for crab of carapace conditions 3 to 5 to calculate residual biomass) divided by the estimated swept area (in square metres) of the trawl at that station (column G) to give kg per square metre.

Multiply each value by 1000 to give tons of crab per square km for each of the 354 sampled stations (you first divide the kg per square metre value by 1000 to give tons per square metre and then multiply by 1 million square metres per square kilometre to give you tons per square kilometre so a shortcut is simply to multiply kg per square m by 1000).

Calculate the average tons per square kilometre over the 354 stations, which equals 1.147 tons per sq. km and multiply this value by the area of the polygon for the southern Gulf (57,840 sq. km) to give you a rough estimate of the biomass (in tons) for the southern Gulf in 2017, which equals 67,403 tons.[1]

Note that this is not the value used in the assessment. The biomass for the assessment is calculated using geostatistics and the value will be different from the approximate value using the arithmetic average.

The data are preliminary. Subsequent quality assurance and verification procedures, including the upcoming science peer review meeting in January 2018, may result in differences between what is currently displayed and what will become the official database. Users should use the information with caution and do so at their own risk. The Government of Canada accepts no liability for the accuracy, availability, suitability, reliability, usability, completeness or timeliness of the data. In no event will the Government of Canada or its employees, servants or agents have any obligation to the user for any reason including claims arising from contract or tort, or for loss of revenue or profit, or for indirect, special, incidental or consequential damages arising from the use of this preliminary information.

Your proceeding beyond this Disclaimer will constitute your acceptance of the terms and conditions outlined above.

In closing, I wish you a very Merry Christmas and best wishes for the New Year.

I look forward to seeing you soon in January 2018.

Thank you,

Gérald Chaput
Coordinator | Coordinateur
Centre for Science Advice | Centre d'avis scientifique
Gulf Region | Région du Golfe
Dept. of Fisheries and Oceans | Ministère des pêches et des océans
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Telephone | Téléphone : 506 851 2022

[1] : *Après l'envoi du courriel, une erreur a été notée dans le calcul de l'estimation grossière de la biomasse de crabe des neiges dans le sud du Golfe en utilisant la moyenne des poids capturés aux 354 stations d'échantillonnage. L'estimation grossière devrait être 66,342 t et non 67,403 t (la surface du polygone de 58,740 km^2 a été utilisé au lieu de la bonne valeur, soit 57,840 km^2). Cette erreur d'estimation grossière, qui est basée sur l'utilisant la moyenne des poids capturés, n'a aucune incidence sur les données d'échantillonnage ou sur l'estimation de la biomasse qui utilise la méthode géostatistique.*

[1]: *After sending the email, an error was noted in the calculation of the rough biomass estimate of snow crab in the southern Gulf, using the average weight caught at 354 sampling stations. The rough estimate should be 66,342 t instead of 67,403 t (an area of the polygon of 58,740 km^2 was used instead of the correct value of 57,840 km^2). This estimation error, based on the average of the weight captured, has no impact on the sampling data or on the biomass estimate conducted with the geostatistical method.*

APPENDIX 5. NOTIFICATION OF DISTRIBUTION OF WORKING PAPERS FOR THE SNOW CRAB REVIEW, JANUARY 17, 2018.

From: Chaput, Gerald
Sent: January-17-18 6:00 PM

Subject: FW: Document message 1 of 3 snow crab assessment for Jan 24-25 2018 / message de transmission de document 1 de 3 évaluation du crabe des neiges les 24 et 25 janvier 2018

Bonjour.

Dans les prochains messages, je vais vous faire parvenir les trois documents qui vont passer en revue pour l'évaluation du stock de crabe des neiges du sud du Golfe du Saint-Laurent.

Les documents à venir sont les suivants :

1) WD01f-Performance de la pêche 2017.pdf: Ce document, en français, présente les informations au sujet de la performance de la pêche en 2017.

2) WD02-Survey activities 2017.pdf: Ce document, en anglais seulement, présente les résultats du relevé de chalut de fond pour le crabe des neiges entrepris en 2017.

3) WD03f-Évaluation crabe des neiges 2017.pdf : Ce document, en français, présente l'évaluation de la biomasse pour 2017, l'analyse de risque des options de capture pour 2018 et des indicateurs biologiques de la population de crabe des neiges.

Dans ce premier message, je vous transmets le document suivant :

1) WD01f-Performance de la pêche 2017.pdf

Nous allons commencer la réunion à 10h00 le mercredi 24 janvier et terminer au plus tard 13h00 le jeudi 25 janvier, 2018. La réunion sera au Delta Beausejour, 750 rue Main, Moncton (N-B).

Un rappel que la participation à la réunion est par invitation, ce n'est pas une réunion ouverte au publique et il n'y pas d'observateurs, ni de média à la réunion.

Enfin, soyez averti que ces documents sont des documents de travail et les résultats, interprétations, et l'avis qui en ressort peuvent changer en conséquence de la réunion de revue par les pairs.

Merci,

Hello.

I will be sending you in a sequence of messages, the three working documents that will be reviewed during the upcoming science peer review meeting of the assessment of the snow crab stock of the southern Gulf of St. Lawrence.

The four documents that will be include:

1) WD01e-Fishery performance in 2017.pdf: This document, in english, summarizes the information specific to the snow crab fishery in 2017.

2) WD02-Survey activities 2017.pdf: This document, in English only, presents the results of the snow crab trawl survey that was conducted in 2017.

3) WD03e-Assessment of snow crab 2017.pdf: This document, in english, presents the assessment of the biomass in 2017, the risk analysis of catch options for 2018, and various biological indicators of the snow crab population.

In this first message, the following document is attached:

1) WD01e-Fishery performance 2017.pdf

The meeting will begin at 10:00 AM Wednesday January 24 and should finish no later than 1:00 PM Thursday January 25, 2018. The meeting will be held at the Delta Beausejour Hotel, 750 Main Street, Moncton (NB).

I want to remind you that participation at the science peer review meeting is by invitation and there are no observers or media allowed in the meeting.

Finally, be advised that these documents are working documents and results, interpretation, and subsequently advice may change as a result of the peer review meeting.

Thank you,

Gérald Chaput

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